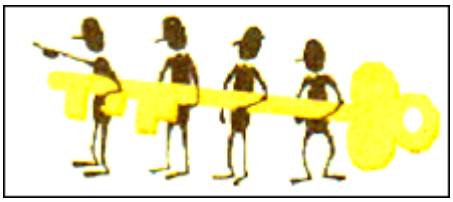

Axioms around the term Information

Single script in connection with a dissertation at University of Vienna, TU Vienna

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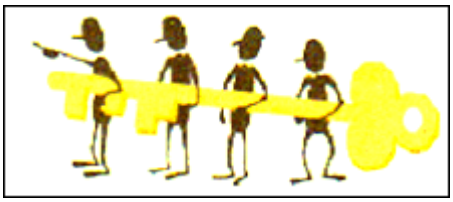
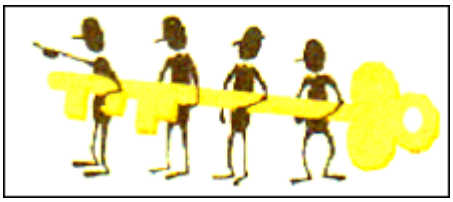
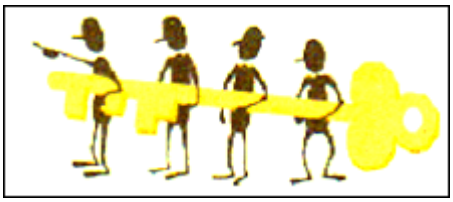


Content

1. Abstract 5
2. Keywords, search items 5
3. The word and term Information in actual theories 6
   3.1. The word Information since antiquity 6
      3.1.1. Old-Greek philosophical roots 6
      3.1.2. Roman philosophy, Latin words 7
      3.1.3. Christian philosophy 9
      3.1.4. Modern and Postmodern usages of Information 10
   3.2. The numeric definition of Information as physical and mathematical term. 11
   3.3. The term Information in (new) Information Sciences (IS) 14
4. Usable theories in Information Sciences (IS) 16
   4.1. Semiotics by PEIRCE 16
   4.2. The semiotic Information Model by C.W.MORRIS 17
      4.2.1. Syntax 17
      4.2.2. Semantic 17
      4.2.3. Pragmatic 17
   4.3. “Form-Content-Effect” by K. FUCHS-KITTOWSKY 17
   4.4. CAPURRO´s Trilemma 18
5. Term Information as bridge to all sciences 19
   5.1. Usage in connection with human 19
   5.2. Usage in *no* connection with human 20
   5.3. Usage as instrument for new philosophical emergencies 21
   5.4. What are the final results of all three cases? 22
6. Information Scientific Axioms 22
   6.1. IA (Information-scientific Axiom) 1 defines the word data to a term: 23
   6.2. IA2 unifies the actual words and terms Information to one 23
   6.3. IA3 connects Data and Information 23
7. New postulate: Information needs a well- known scientific correlation. 24
   7.1. IP1: Human Orientation of IT 24



7.2. IP2: Continuity of IT 24
7.3. IP3: Correlation to a legacy scientific term, by using the word Information. 24
8. The “implantation” of these IAs in actual IS 25
8.1. IAs and Semiotics by CH. S. PEIRCE 25
8.2. IAs and Information Modell by C.W. MORRIS 25
8.3. IAs and the trias “Form-Content-Effect” by K.FUCHS-KITTOWSKY 26
8.4. IAs and CAPURRO´s Trilemma 27
9. Used literature 28



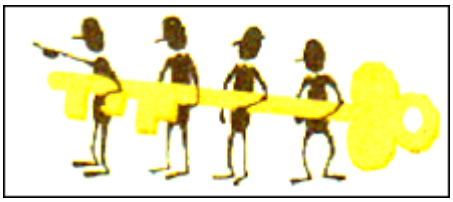
… different conceptions of fundamental terms like "Information" are thus more or less fruitful, depending on the theories (and in the end, the practical actions) they are expected to support.

Raphael CAPURRO, Birger HJORLAND (2003) in (6 p 4)

Almost every scientific discipline today uses the Concept of Information within its own context and with regard to specific phenomena…..

Raphael CAPURRO, Birger HJORLAND (2003) in (6 p 13)

For my daughters Clara and Isabelle…



1. Abstract

The word “information” has got a very high relevance since his first usage for technician purposes in the year 1928 by R.V. HARTLEY in his script “The Transmission of Information”. The better known scientist C.E. SHANNON has token it from HARTLEY.

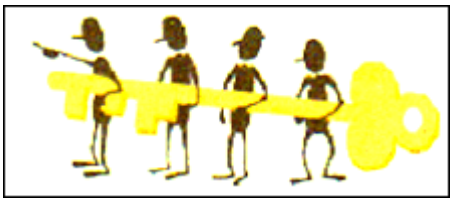
This usage was historical, because since that time this term “Information” got very famous in scientific circles. Today we use it in uncountable and not observable cases in all branches of our present sciences. We call our age the Age of Information.

A desired worldwide unified definition of this term was till now not possible. Therefore new tendencies try to notify all existing definitions and differentiations. Building an amount of all relevant usages and abstracting common properties out of these elements – seem to bring a long time Unified Theory of Information (UTI).

In this work a possible new trial is written down and scientifically embedded. The result is surprising simple and grate.

2. Keywords, search items

Information, Unified Theory of Information (UTI), Theoretical Informatics, Information Sciences, Human Computer Interaction (HCI), Paradigm for Human Orientation of IT (HOP-IT), Semiotics, Self-Organisation, Cognition, Communication, Cooperation, Intelligence, Self-Consciousness, Evolution, Emergence



3. The word and term Information in actual theories

After one decade in our **Age of Information** the science is frustrated by the huge diversification in usage of the word and term “Information”.

The intentions of philosophers, information scientists, computer scientists, mathematicians, sociologists, communication scientists, physicians, biologists, neurobiologists and psychologists till now could not find a common usage of word and term “Information”. Every science used the word and term since about 50 years - but not synonym.

So let us follow first the etymological way of the word.

3.1. The word Information since antiquity

Etymologic researches since the age and culture of classical Rom have been done. Even in Old-Greece philosophy this word can be found - by various semantics.

3.1.1. Old-Greek philosophical roots

In relation between ontology and epistemology in GREEK philosophy of PLATO and ARISTOTELES significant concepts around ειδοσ/ιδεα, μορφη and τυποσ can be found ((4) Raphael CAPURRO (1996)).

In (5) Wilhelm GEMOLL (1962) is to find

ειδοσ, ουσ, το means: “outward appearance, look, form, figure, stature” or

“original, prototype, ante type, idea, term” or

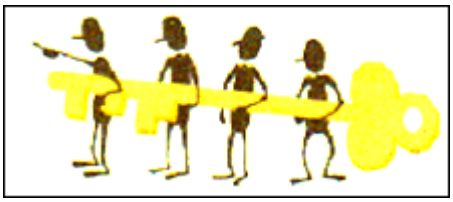
“sort, type” of a “class, category or species” or

“proceeding, consistence, status, habit or nature”

ιδεα, ασ, η or ιδεη means “look, standing, stature, shape” or

“consistence, manner, mode” or

“meaning, image, idea”



μορφη, ησ, η means “beautiful shape, habit or figure” or

“from accident or incompleteness freed form = idea” or

“ionic: quality”

τυποσ, ου, ο means “beat, knock, impact” or

“something pressed or impressed, imprint, picture” or

“outline, shape, form, sketch, drawing” or

“example, ideal or prototype”.

It´s remarkable: all these words are involved in information scientific themes and concepts of present time. Therefore a nearly equivalent relation between information science and philosophy around the term Information is sourced already in this Greek philosophy.

3.1.2. Roman philosophy, Latin words

LATIN translations and commentaries of these concepts appear in Antique Roman Culture in the words and terms **informatio/informare**.

In (7) J.M. STOWASSER (1963), Latin-German lexicon is to find

informatio, –ionis, f substantive, means “imagination”

informo, -are verb, means “form, mould, configure, build (animum)” or

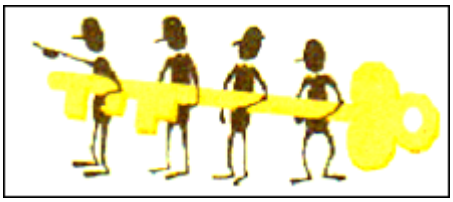
“educate, teach (ad humanitatem)” or

“describe, illustrate” or

“think, imagine”

informis, -e adjective, means “without form, not formed, deformed” or

“not beautiful, ugly, nasty, gross”



According to (6, p 9) Raphael CAPURRO, Birger HJORLAND (2003) the translation and usage in Latin can be found also in Thesaurus Linguae Latinae (1900).

In general two basic contexts - tangible (**corporaliter**) or intangible (**incorporaliter**) - can be found.

The prefix “in-“may have the meaning of negotiation as used in the attribute informis or the substantive informitas, but in our case it has the accusative meaning of “bringing something into a form of something”.

VERGIL (70-19 b. C.) uses the word in his verses on Vulcan and the Cyclopes (Aen. 8,426 and Aen. 8, 447) in connection with (**informatum**) hammering out lightning bolts for Zeus or a huge shield for Aeneas.

Marcus Terentius VARRO (116-27 b. C.) uses the words in a biological context, how the foetus is being informed (**informatur**) by head and backbone (Frg. Gell. 3, 10, 7 = fragment of Aulus GELLIUS, a Roman writer in 2. century b. C.).

TERTULLIAN (ca. 160 – 220 b. C.) calls Moses **populi informator** = peoples educator or molder.

Informatio and informo are in some cases used as translations of the Greek words

΄υποτυποσισ = model in moral context or

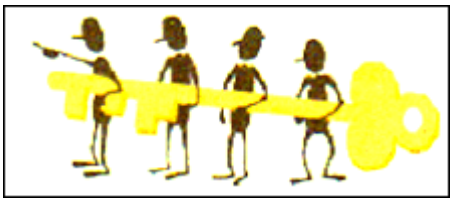
προλεπσισ = representation or

in higher level ειδοσ, ιδεα, τυποσ or μορφε used by CICERO or later AUGUSTINUS

CICERO (106 – 43 b. C.) translates in EPICUR (341-270 b. C.), De natura deorum, the concepts of προλεπσισ = representations in our souls before any experience as **informatio rei** (nat.deor. 1, 43).

In De oratore (2,358) and in Orator (orat. 10) he uses Plato´s ιδεασ as **ars memoriae** by **sententiae informatio** = to describe an active or a posteriori action of the mind for better remembering through the pictorial representation of a sentence. CICERO recognized already a form of our present term “pictorial memory”.

He uses the word inform in biological, pedagogical and moral contexts in his speech Pro Archia.



3.1.3. Christian philosophy

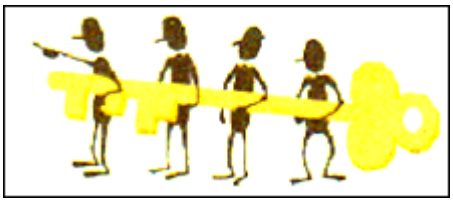
The used scientific source is (6, p 10 ff) Raphael CAPURRO, Birger HJORLAND (2003).

AUGUSTINUS (354 – 430) is thinking and acting in tradition of Greek ontology and epistemology and the new Christian tradition. He is one of the most important thinkers in early Christian theology and philosophy. In De trinitate he calls the procedure of visual perception **informatio sensus** (trin. 11, 2, 2) and he uses in (trin. 11, 2, 3) the metaphor of impression (**imprimitur**) of a seal into wax. The origin of this metaphor comes from PLATO (Theaet. 191d) and ARISTOTELES (De an. 424 a 17). In surrounding of the theme memory he was very near to the nature scientific truth which is known today. He thought that the images or representations of perceived objects are stored in memory. Today we can say that this was an early thesis in neurosciences which is proved as real and true today. In other cases his theses have been more evaluable assumptions, that didn´t get the nature scientific glory of truth today: From PLATO he took the meaning, images do not inform the soul (**mens**) or the rational intellect (**inteligentia rationalis**) but reflect (**cogitatio**) possible internal representations (**informatio cogitationis**) (trin. 14, 8, 11). He didn´t see all these terms in one connection – as one biological and mental system as we can do it today by neurosciences. These differentiations – defined in new terms - shows that he tried to analyse our human brain, but without any help by nature science (biology).

AUGUSTINUS used **informatio** also in a pedagogical context. He saw CHRISTUS as God´s form (**forma Dei**). His deeds instruct and educate us (**ad eruditionem informationemque nostram**) (epist. 12). In De civitate Dei, he uses the words **informatio civitatis sanctae** (civ. 11, 24).

So all the time after AUGUSTINUS the ontological, epistemological and pedagogical usage of **informatio** and **informare** were defined - till

Thomas AQUINAS (1225-1274). Roberto BUSA (1975) lists in his Index Thomisticus 66 references on **informatio** - 15 of them in nominative. Also 454 references on the verb **informo** can be found. Thomas AQUINAS is also following ARISTOTELES in his concepts of form (ειδοσ or μορφη) and matter (΄υλε). They cause the unity of an individual being (**informatio materiae**). This theory of ARISTOTELES was called **hylomorphism**. So the too much differentiated theory of AUGUSTINUS, as found above has been redefined. Thomas AQUINAS distinguishes between the biological procedure *giving life on the basis of something that already exists* (**per modum informationis**) and the *act of creation out of nothing* (**per modum creationis**) (In de causis 18/94). He makes an ontological difference between **informatio** in different beings and the **creatio** of all that beings in general**.** Because of the *unity of the human body with the soul* as substantial form (**forma substantialis**) he underlines *one knowledge procedure in two movements:*



a) the **informatio sensus** as the abstracting (**abstractio**) of forms (forma, species) – ARISTOTELES called it ειδοσ or μορφη – today we would say: *the sensual perception of form of objects* - and

b) the **informatio intellectus possibilis** by going back to the things in a sensory bounded intellectual re-cognition (**conversio ad phantasmata**) by using the **intellectus agens** – today we would say: *the cognitive storage in our memory*.

In his (Summa theol. I, 14.2.co/4) he connected mental activities to a correlating procedure. Why he could do this, is a question, but the biological provable facts in our time give him the glory of nature scientific truth. He supposed already or made a thesis of a nature scientific law found primal in about 1950 by D. O. HEBB.

In other usages - as **informatio virtutum** or **informatio morum** – he is in agreement with AUGUSTINUS in pedagogical and moral sense (Summa theol. III, 110.4.co/15).

With the decay of Scholastic philosophy in the Middle Age and the rise of Modernity the *ontological* meaning (form, material) becomes unusual and the *epistemological* one (imagine, teach, describe) remains.

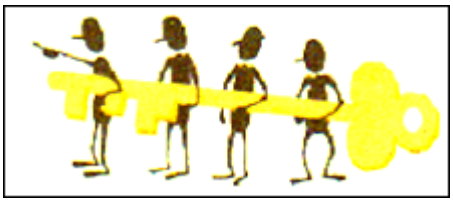
3.1.4. Modern and Postmodern usages of Information

Again as scientific source (6, p 11 ff) Raphael CAPURRO, Birger HJORLAND (2003) is used.

Information changes from “giving a (substantial) form to matter” to “communicating something to someone”.

The new philosophical ways of thinking in Modern stayed taking the real nature as source of the science but criticised the theoretical theories before. A step in human-mental evolution was done. The human way of understanding the nature got more differentiated. Two main philosophical streaming’s can be found: **Rationalism** (French DESCARTES) and **Empirism** (English LOCKE).

René DESCARTES (1596 – 1650) calls ideas the “forms of thought”, not in the sense that these are “pictured” (**depictae**) in some part of the brain, but “as far as they inform the spirit itself - orientated to this part of the brain” (“**sed tantum quatenus mentem ipsam in allem cerebri partem conversam informant”** (Descartes 1996, VII, 161).



Comparing with actual nature scientific point of view (neurosciences) we can say, he proposed a topologic centre in our brain, a physical areal and a real existent representation in our brain, where ideas are created and serviced. He made a connection to *more than a mental picture*. The question is how he could find this today real valid concept?

René DESCARTES can be seen as the finder of "doctrine of ideas". In Scholastic a common understanding of nature and intellect was valid. Our mind works in all facts like he realizes the nature. DESCARTES sets his "**doctrine of ideas**" between nature and intellect. He said – translated in our actual state of knowledge - that there must have been an (evolutional) *emergency* in our mind – **the idea**. An "idea" was something present to the mind, an image, copy or representation, with a problematic relation to real things in the world. For empiricists (like LOCKE) the stream of ideas was the raw material from which genuine *knowledge* could be built. For rationalists (like DESCARTES) it was a veil of illusion, to be pierced by logic and reason. Both have been sure that something like this has to exist.

Out of present science we can say, both have been correct. Some centuries later PEIRCE (1860) found his SIGNs-Concept (Semiotics). Neurosciences (since about 1900), mainly D.O.HEBB (1904 – 1985) found biological backgrounds of higher mental possibilities of our brain - intellect and creativity - for development of new ideas in a more detailed way.

3.2. The numeric definition of Information as physical and mathematical term.

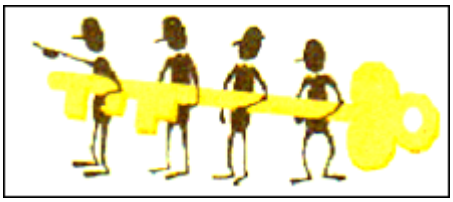
Used literature: (22) F.W. HAGEMEYER (1979),
(23) G. KRAUS (1972) and
(3) F.PLOCHBERGER (2011).

In 1924 Harry NYQUIST (1889-1976) published "Certain factors affecting telegraph speed" and had problems "by transmitting the maximum *amount of intelligence over (electronic) circuits*". He used theories of mathematical probability for his n *signal elements* in m currency-steps (of +, - 2 and +, - 3 or 0 mAmpere) to define a *character*. He originated the maximal value of different transferable characters by the formula

$$\mathbf{m^n = const}$$

n used signal elements of possible m currency pulses (=height and width of signal element).

R.V.HARTLEY (1888-1970) used the formula of NYQUIST to define the "*amount of transmissible information*" to get a common definition. HARTLEY defined



$$H = \log m^n = n \quad \text{[Hartley or bit]}$$

Unit is **1 Hartley** by using basis 10 for log or **1 bit** by using basis 2. H is always an integer.

If we use a device with one decimal signal element "the maximal amount of transmissible Information" may have 10 possible values and has the value of 1 H(artley), if we use one digital signal element it may have 2 possible values. The value of "the maximal amount of transmissible Information" is then 1 bit. The unit *bit* is an abbreviation of "binary digit" and has been used first by J.W.TUKEY. SCHANNON published it 1948. If we use 2, 3, or more signal elements with 10 or 2 possibilities of value we get analog 2, 3, or more Hartley or bit. So "the maximal amount of transmissible information "– unit Hartley or bit - gives the number of used signal elements = a physical part of a device or storage-element. We can say: we use so much bits (or Hartleys) to transfer or store a certain character (sign).

HARTLEY added to his theory: „based on physical as contrasted to psychological considerations" (1928). He really excluded all other usages of information.

But never the less he stimulated a connection to the legacy usage of the word in common language and philosophy (in semantic of the Latin word informatio). All legacy definitions of **informatio/informare** where activated again in the following time till 1950 (F. PLOCHBERGER, 2011) (3, p 6 ff).

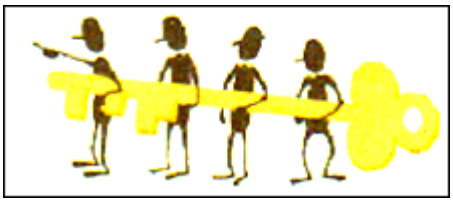
The next important mathematician in new technology of communication was **Claude E. SHANNON** (1916-2001).

Since his publication of "A mathematical Theory of Communication" (1948) he was named the "Father of *Information Theory*". He is said to be the originator of these mathematical theories around transmission of messages in physical channels. He created a model of a channel. He defined

Information Content I (p) = - log (p) = log (1/p) [bit, Hartley]

The unit **bit** is used if log has basis 2 and **Hartley** if log has basis 10.

Today it´s important, that Information Content is reciprocal to probability. The Content of Information increases if probability decreases and vice versa. In other words an Information Content increases if the probability of appearance decreases = the appearance of an event is less expected and vice versa.



This definition is in first moment another one than HARTLEYs “maximal amount of transmissible information”, which depends from n physical signal elements and m currency-pulses: the **NYQUIST-formula m^n.**

How can be found a connection? If we suppose, that all events have the same probability, we find the probability of every equivalent distributed event by $1/m^n$. Using equivalent distributed *digital* signal elements we can write:

$p= 1/2^n$ n is the amount of digital signal elements;

2^n is the maximum amount of different transferable or storable characters or signs.

Now $1/p = 2^n$ or ld (1/p) = n or – ld p =n [bit].

And that´s **SHANNON´s Information Content I (p).**

SHANNONs Information Content is a new mathematical value. But his term got too in contrast to the legacy term information. Today we can use the term, as mathematical definition, if we have a valid mathematical probability p for every event.

Many variations have been counted out by SHANNON et al. Especially in case of noise, in case of dependences of one single signal from that before or later or in case of Channel Capacity he had found a lot of formulas. One is for example:

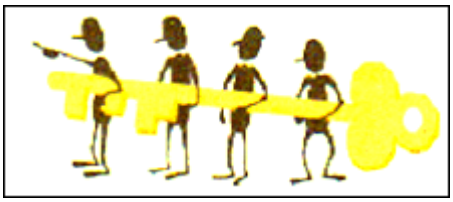
Entropy or Average Information Content $H(X) = \sum_{i=1}^{n} p(x_i) * I(x_i)$

$$= - \sum_{i=1}^{n} p(x_i) * ld\ p(x_i)$$

X is defined as set of possible single events $x_1, x_2 \ldots x_i \ldots x_n$.

H(X) is a sum of n events x_i with i single “by ($p(x_i)$) weighted” Information contents $I(x_i)$. It’s also named “SHANNON´s Entropy” or “Information Entropy” and had been created as new mathematical term.

It differs to legacy physical Entropy only by a constant factor k_B = Boltzmann-constant and ld (logarithm digitalis with basis 2) instead of ln (natural logarithm with basis e).



Today the term *Entropy* as measurement of Disorder is not so much used as the term *Information Entropy* or *Average Information Content*.

3.3. The term Information in (new) Information Sciences (IS)

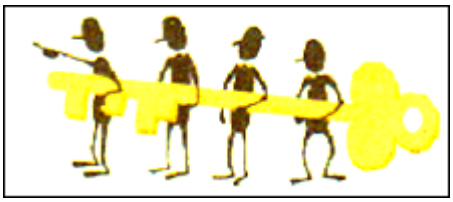
a) These new technical based definitions of terms and units in mathematician formulas got too fascinating. So they have been criticized by legacy philosophers, although HARTLEY correctly proposed "**contrasted psychological considerations**".

b) A second source of (new) Information Sciences can be seen in Ethel JOHNSON, an American librarian, who already in 1915 had made the word Information to a term. By him is noted: "before everything else, it **(the special library) is an information bureau**. The main function of the special library is *to make information available*." ((6, p 28) Raphael CAPURRO, Birger HJORLAND (2003)).

c) This term Information got a further (third) new importance through usage in term *Data* ((8) Franz PLOCHBERGER (1999)). In that time the term Information was uses in most cases in connection to the term **Data**. Data increased in their relevance for IT.

d) The next (forth) important step for much more relevance came by finding of **WWW by Tim BERNER-LEE (1989) and Hypertext by Robert CAILLIAUT (1990).** The medial communication by Internet got easy and quick. The worldwide net of communication by Internet is a fix positive result of our whole human world and has an immense relevance.

A fitting example of importance of IS in actual life is **Information Retrieval (IR)**. It's the possible most important field of IS in present time. We have a lot of stored knowledge in WWW, common and private databases, Knowledge Systems (private or public), Librarian Systems and Search Systems (f. i. GOOGLE, Yahoo or Web). All together store an object Data in "Data Objects". The systems are all organized in a formal algorithm and can be retrieved by genuine logical formal Search-Software. The real creative and intelligent part lays in the configuration of a search-term (a data string) and this can be done by human in creative way only. All formal defined values and structures can be involved in a formal defined and structured Search-Software-System. In



ideal way of finding a stored document exactly as we created it, we can say that these data are the IA-data form of 1:1 or Natural Data (see IA1 later in this script).

Since existence of Information Sciences (CAPURRO) some scientist tried to find a Unified Theory of Information (FLEISSNER, HOFKIRCHNER) since about 2000 ((14) R. CAPURRO, P. FLEISSNER & W. HOFKIRCHNER (1999)).

Main usages of the term Information can be seen in three contexts:

a) **cognition**

b) **communication and**

c) **cooperation.**

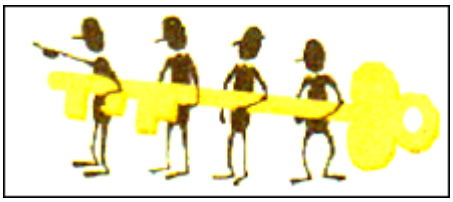
But also a not definable amount of usages and semantics of the word and term Information can be found in present time.

In (9) Franz PLOCHBERGER (2002, 2012) tries to find a solution by a new naïve nature scientific concept. He sets *Information Scientific Axioms*. See IAs later in this script.

As conclusion we can say that we can use the word Information in all cases as we did till now, but we should know the scientific context and meaning in its scientific surrounding.

If we use the word we always will *find a connection to another already scientific known or even new term.* This found term we should take as theme for our scientific researches. Information is a very multi-semantic term. We should soon try to find a more specialized one in addition, because so we can find the ***real scientific relevance***. For example: Information Sciences in the semantic of Ethel JOHNSON can better be named as Science of Knowledge (stored in our books) or Science of Organization of Libraries (by IT).

Information Sciences - in usage as defined in (9) Franz PLOCHBERGER (2002, 2012) - bring the synonym of *Information Sciences* and *Philosophy of Information*. If we understand philosophy as science for and from human (KANT), we can even use philosophy only without the containment “of Information”.



4. Usable theories in Information Sciences (IS)

4.1. Semiotics by PEIRCE

Charles S. PEIRCE (1839 – 1914), an US-American mathematician and pragmatic philosopher, defined in 1860 his "**Semiosis**" as "*an action, or influence, which is or involves a cooperation of three subjects*", to day better to say "three independent separate (logical) elements":

a) **Object,**

b) **Sign** and

c) **Effect** on an **Interpretant.**

These have a triadic relation, no disaggregation into possible dual relations is allowed. The effect in the interpretant he called "**Meaning**". The interpretant can be called also subject. He made a lot of possible differences in signs, but mainly three stayed usable till today:

a) **Icon**

Today we can say: "Graphical Picture", which is similar to the object. It creates an irreducible relation to a group of real objects and a Meaning in a subject.

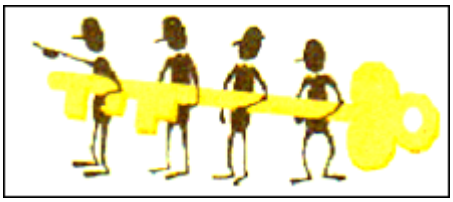
b) **Index**

Today we can say: a Sign – similar to a variable - which can change his relation to an object in spatial and temporal properties and relates to certain Meanings in Interpreter.

c) **Symbol**

Today we can say: a definite relation between object, Sign and Meaning, created by a cognitive proceeding by one or more circles between object and subject. The subject (Interpretant) may think or even talk about more than one possibilities of the appearance of the object. The subject builds a decision and sets a resulting action.

These definitions have been made 150 years ago - 100 years before the first computers and IT have been created – but the usability is yet an admirable positive fact. See also (18) F. PLOCHBERGER (2011) and (19) S. RIBEIRO et al. (2006).



4.2. The semiotic Information Model by C.W.MORRIS

Charles W. MORRIS (1901 – 1979), an US-American semiotician and philosopher, in ((15) C.W. MORRIS (1972)) makes another useful differentiation:

4.2.1. Syntax

A syntax shows a relation between signs. On basis of combination of different signs understandable new sign-combinations (f.i. words) with new semantics can be evaluated by definite rules (f.i. a command line in a computer program). The new signs are new useful facts and the rules are defined.

4.2.2. Semantic

Semantic is an effective relation between signs and objects. The signs are symbols for the meaning or relevance of an object (f. i. a graphical symbol as sign for a set of well-known objects.). Semantic explains an object.

4.2.3. Pragmatic

Pragmatic takes care on the relation between signs and the user (subject) who acts with the signs. In that case the individual understanding of a sign is important. According to semantic of a sign for the user, the user sets certain actions (f.i. he stops his car at a stop-signal in common traffic).

4.3. "Form-Content-Effect" by K. FUCHS-KITTOWSKY

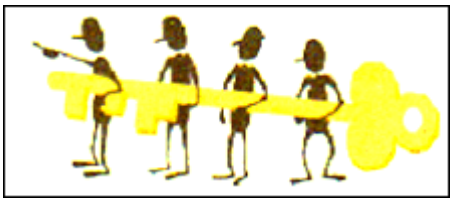
Klaus FUCHS-KITTOWSKY (* 1934) a DDR-German scientist in ((17, p 146) Klaus FUCHS-KITTOWSKY (2008)) differentiates the alternating condition relation in a procedure of creating (new ideas) and usage (cognition) of Information by the trias:

- **form (Syntax),**
- **content (Semantic)** and
- **effect, action** or **output (Pragmatic).**

Form is abstractable as "a physical property of an object" (structure).

Content relates between two terms: object and subject.

Pragmatic relates to the subject and contains cognitive understanding and creating of a decision with following action by the subject.



All together can be seen as connecting terms in **a (human) information – procedure** (= cognition or creating of new ideas). I don´t like to use the word "process" in connection with human cognition. Franz SEITELBERGER (1916 – 2007), a Viennese neuroscientist said in about 1995: "*in human brain no temporal defined process with certain start and end is possible, the brain works permanent*". See also Paul WATZLAWIK (1921 – 2007), the originator of Communication Theory, in his sentence: "You can´t *not communicate*".

4.4. CAPURRO´s Trilemma

In ((21, p 1ff) Peter FLEISSNER, Wolfgang HOFKIRCHNER (1995)) wrote it down after many discussions with Raphael CAPURRO.

Only three possibilities of more than one meanings of the term Information are thinkable:

a) **all terms are exactly the same (synonym, univocal),**

b) **all terms are a little bit similar (analog) or**

c) **all terms are something complete different (equivocal).**

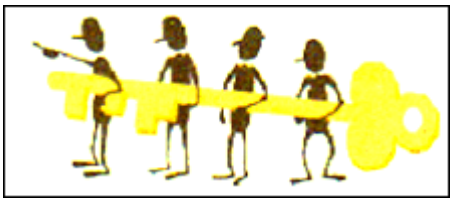
Of course that´s a reduction to special cases, but the possibility to order the grate amount of term definitions gets easier. This was written in 1995. The grate amount is of course a mixture of these three possibilities of organizing the problem-solving (2010).

In case (a): Information would be the same for a material stone in physics (matter object) or a term in cognitive human psychology (knowledge in human brain). That's not thinkable.

In case (b): Information has to have a definition of a **primum analogatum**, to make it comparable to others. But then no analog connection between anthropomorphic-living and physical-materialistic using is thinkable. An atom can´t communicate like a human being. This was also not thinkable in 1995. Today (2011) we have a possible solution in a more abstract and naive way (see IA1-IA3 by F.PLOCHBERGER later in this script).

In case (c): by using the term Information in all events and contexts, we come into a Babylonian confusion of terms, which is no basis for science. Exactly these facts are valid in present time and many cases.

Therefore a postulate of Unified Theory of Information (UTI) was set in 1995 (FLEISSNER, HOFKIRCHNER) but was till now not possible. Today we try new scientific ways – in legacy using (in language) and new naive nature scientific terms of IT. See later at axioms.



5. Term Information as bridge to all sciences

The usage of the term in present time can be seen in three main cases:

5.1. Usage in connection with human

The connections between human being and the term Information are so manifold, that all scripts using it can never be known to one single human being.

It makes sense to summarize in scientific concepts and headlines and to make a *logical abstraction* out of them.

Concepts of Information have been worked out by:

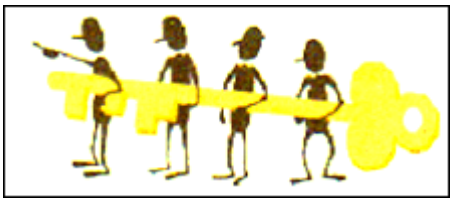
a) **Philosophy and Information Sciences** contain an endless queue of terms, definitions and differentiations. Therefore the postulate of a common definition of the term Information aroused. Since about the year 2000 some Information Scientists ((14) (R.CAPURRO, .FLEISSNER, W. HOFKIRCHNER)) try to find such a unified theory of information. A lot of differentiations of usage of the term appeared, but no definitive success of one definition is usable till now. The logical background seems to be that the term Information is a term with too many semantics in human live. Every definition or concept brings new, not fitting facts or usages in other contexts and causes again new differentiations, which also can´t be defined satisfyingly.
Information Sciences and Philosophy seem to be nearly the same. Only the word Information has to be redefined - not deductive as tried till now but inductive from real usage. Binding all usages together – not by semantic but more by common properties of all usages – makes a nature scientific naïve - but general - solution thinkable – see later at axioms.

b) In **Psychology**, especially in 1956 “the Information-Processing Paradigm”, a cognitive revolution, brings the roots of “**Cognitive Science**” (1975) (GÄERDENFORS 1999). Next main headlines are “**Communication Sciences**” (WATZLAWICK) and new versions of “**Language Theories**”. In all these the term Information is redefined in new differentiated ways.

c) In **Biology** Evolution, Outopoiesis are (re)defined by Humberto MATURANA and Francisco VARELA (1980). Information and evolution are combined and differentiated.

d) In **Sociology**: LUHMANN (1987), WEBSTER (1995) uses the term.

e) **Informatics or Computer Sciences, Information Sciences**: In real informatics BERNER-LEE (1989) defines the WWW. CAPURRO (2001, 2003) tries to write down all uses of the term Information in theoretical works.



f) **Knowledge Management, Librarianship and Scientific Documentation:** HJORLAND (2000) follows the way of human knowledge. He and many others try to find common concepts of management but the differentiations are too manifold and specialized.

It's too difficult, to find and write down all definitions of the term "Information". What we can say just now is that every science defines its own version of the term.

So we can´t say: it´s a well-defined term, but it´s a very much used word in common language. One common property is *that all definitions are given by human*. Not more is possible to abstract.

5.2. Usage in *no* connection with human

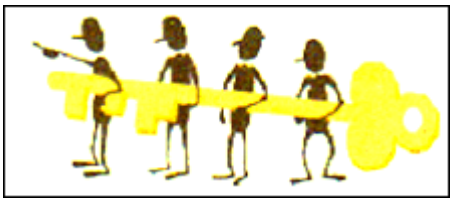
The roots of this way of thinking are in the physical and mathematical definition in the "**Theory of Information**" in the years 1928-1950). H.NYQUIST, R.V. HARTLEY, C.E. SHANNON and W.WEAVER tried to find a mathematical theory about sending of messages in new created physical channels. At the beginning of telegraphy and telephony technical possibilities should be improved by physical and mathematical formulas. In mathematics the numeric theories about probability – especially the mode of "variation with repeating (= m^n)" brought the satisfying formula. From first moment "psychological considerations" should be excluded.

But the term Information was already predefined by philosophy since the old **Greek Antique**, so the genuine mathematical definitions in the "Theory of Information" caused soon a broad reaction of all sciences.

In (16, p 584) **G.BATESON (1985) evaluated new the word "data**" and used both terms "data or information's" in yet common semantic.

System Theory and Cybernetics brought new definitions: Norbert WIENER (Cybernetics or Control and Communication in the Animal and the Machine, 1948) is regarded to be the originator of Cybernetics and Heinz von FOERSTER (1980, 1984) the originator of Second-order Cybernetics. They tried to find mathematical theories about systems. The new science was called System Theory (Ludwig von BERTALANFFY, General System Theory: Foundations, Development, Application., 1968). Today these theories are further used mainly in connection to **Quantum Physics**.

Information is in most cases used for "***something that is not yet definable, but exists***" or "***something recognized but not yet definable***". The form of matter in all cases of quantum physics is also defined as "intrinsic information" ((10) STON IER 1991 or (11) K. DEVLIN 1992). On the other side (13) G. MAHLER 1996 defines these facts as "**interpreted data**". He used too a second concatenated term which got importance: "Data".



A quantum bit or “qubit” is therefore to new unit used in quantum-physics (DiVINCENZO 2000) - like old relays or transistors for the legacy unit “bit”. Nanotechnologies found in 2011 a new storage element for one bit in only twelve atoms (Sebastian LOTH et al.)

Furthermore in ((12) KÜPERS (1996)) KÜPERS remarks: The majority of biologists, especially **molecular biologists**, appear to accept that “*biological information is indeed a natural entity, which expresses itself in the **specific structures** of biological macromolecules”*.

So a new term is bringing a possible usable connection: “Data”. A lot of semantics of the term Information in nature science are definable by that new - and therefore important - fact and term. The term Data is the missing link on the way of in theoretical works in Unified Theories of Information (UTI) like ((1) HOFKIRCHNER, FUCHS (2000)).

5.3. Usage as instrument for new philosophical emergencies

All these definitions and differentiations around the term Information can be seen as order of God or time to human scientists to train their intelligence and creativity. But till now this order seems to be a Zen Buddistic Koan.

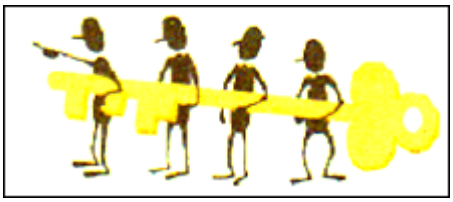
New impulses out of our human creativity come again and again. They come from philosophy and information sciences on one side and the whole nature around us on the other side.

Philosophy and information sciences find new universal rules or definitions, because our new Information Society is now possible to communicate and think together nearly synchronically in electronic speeds all over our planet earth. The interesting themes are outside in the cosmic universe and inside in deeper steps of microcosm and nanotechnologies and can´t be finished by any state of human knowledge. We need and search further in new common theories which reflect little steps on the way of the **nature scientific truth**.

Information seems to be a word with too much term-definitions in all our sciences. But we feel the importance of the word, because we use it very much in common life and many theories in all sciences.

So this word (information) has a common usage, but the relevance is not based on its context-dependent semantic per se***. Its relevance is sourced in his usage by the human being.*** Only this relation can be used as significant property. All other semantics are not definable in a satisfying unifying way.

Otherwise we can use only a defining form: “It is something (physically or mental) existing, which … (followed by a special description or specification)”. Most of these forms are different.



5.4. What are the final results of all three cases?

Out of nature-science comes the empiric naive - but in general valid - approach of using real objects in our real world. Every object of our perception can be seen as basis. Every object has a form and as much properties as much we can differentiate.

If we analyze an object we give him attention by turning our mind and our senses on him. We find characteristic properties, which we can direct compare with stored data in our brain – our knowledge in our memory.

Or we can make new descriptions - without deeper thinking - on paper or by electronic media by creating data.

If we give no attention to an object the object is existing in our real world, but we don't have or use data or information about the object

The connecting term to an existing object is "existing data – living in our memory or stored by media". Both (object and data) are correlating per se.

If we define Information as "that, what is in data or objects" and "that, what we (as human beings) can recognize" we have a possible definition of the terms.

That's a possible result, very common but valid in all cases of above script.

6. Information Scientific Axioms

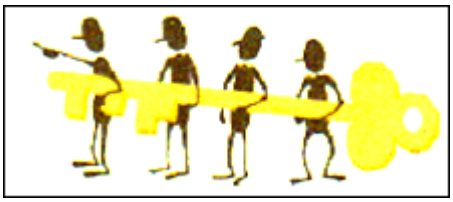
Information Sciences, Theoretical Informatics or Theoretical Computer Science are sciences around the terms Information, Data, IT-System.

Two main axioms can be written down, one for the word and term Information and one for the word and term Data.

We use these words and terms in our Century of Information very much, but till now we have no satisfying common definition. Here a trial by nature scientific naive definition by axioms is pointed out.

Axioms are defined as fundamental sentences, which don´t have to be proved by other sentences. They are the basis for sentences, which follow out of them and build together a logical theory.

These axioms have to be true facts of nature and objective human world which can´t be changed. We take them as not provable but existent, true and valid. The real reward is to find them.



If the axioms are true and valid the system built out of them should be also true and valid. It must be possible to understand something better or to solve problems by using these axioms.

6.1. IA (Information-scientific Axiom) 1 defines the word data to a term:

By Data an object of our real world is described.

Because an uncountable amount of possibilities of description and structures is existent,

only three main groups of Date are pointed out:

a) **written down, materialistic, dead Data** (books, scripts, IT data, and so on)

b) **living Data** in living organism (neuronal energies and entities in nerve systems, macromolecules and so on)

c) **1:1 Data or Natural Data.** They are a special group, because we only have to keep them for documentation of objects in our nature (nature films, documentations and documents). Their criterion is: they make an object storable and revisable as it is – without any change.

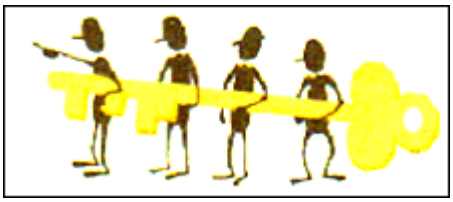
6.2. IA2 unifies the actual words and terms Information to one

Information is that about an object or in data, what is relevant for a human being. For existence of Information a human being is necessary (logical implication: Information -> human being). Without a human being Information is not possible.

The human being is a substitute for all living objects (animals or plants according to their evolutional status).

6.3. IA3 connects Data and Information

The value of Data is defined by the included Information.



The terms Data and Information are used in undefinable amounts of details and differentiations in literature and science before. These axioms are able to stay unchanged and define unique terms.

7. New postulate: Information needs a well-known scientific correlation.

Two postulates for IT are already known by F. PLOCHBERGER (2009):

7.1. IP1: Human Orientation of IT

IT (Information Technology) is a human artifact and has immense influence in human life. Therefore certain rules have to be known. They are defined in ISO 9241 (Ergonomic and HCI). In **HOP-IT** (HO Paradigm of IT) of F.PLOCHBERGER (2011) they are formed to a new paradigm for whole IT as follow up to OO (Object Orientation).

7.2. IP2: Continuity of IT

The technical background of IT invites to develop process-orientated software. But the human brain doesn´t work like a machine by stop and go, it lives permanent. A **continuous flow** of information and data is permanent in the whole human system of nerves.

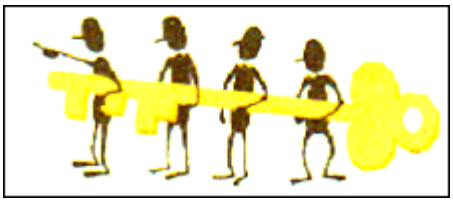
What we need is therefore a consequent continuity of all our actions or a certain connection to well-known knowledge contents in our memory.

We have to make **continuity to a principle** in modeling of all our IT-systems.

7.3. IP3: Correlation to a legacy scientific term, by using the word Information.

This postulate was written down in 2012 first time. If a scientist uses the word Information, he should know the exact scientific semantic of the word. In most cases he will also know well-known legacy terms of science.

The scientific foundation of this postulate is to find a fitting term in the history of the word Information. We use it in too manifold connections. In most cases the term-usage of Information is possible but is not yet scientific enough. The user should know the IAs (Information Scientific Axioms of Franz PLOCHBERGER (2011).



If a scientist don´t know these IAs we have to enforce him to give an exact definition of the usage of the term Information in his context, at least a *primum analogatum* (see 4.4. in this script) to the AIs will be scientific enough. So we can take the benefit of this postulate IP3, because we can expect legacy scientific terms and results and no common words only.

In a similar way P. JANICH, a philosopher, born 1942 in Munich, was thinking ((20 p 5) R. CAPURRO (1998)). P. JANICH wants to use the term Information only in context between human beings. He postulates also: If someone uses the term in other connections, he should say in clear words how these applications differ.

8. The "implantation" of these IAs in actual IS

8.1. IAs and Semiotics by CH. S. PEIRCE

The term *Object* is no problem; we can use it in same way as PEIRCE did it.

The term *Sign by PEIRCE* is definable as special form of the term *Information in IAs.*

The terms *Effect, Interpretant and Meaning of PEIRCE* are useful for IAs too.

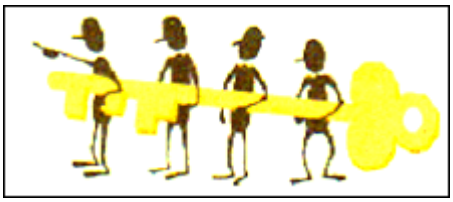
Effect is the stored *Information* in the memory of the *Interpretant. Subject* is a more abstract term of an *Interpretant.* An *Interpretant* is a cognitive acting *Subject.* He communicates his *Meaning* to other *Subjects*. We can come to nature-scientific truth if we use *Meaning* as *Information or even "living" Data* (= stored knowledge) in our human brain. Today we can say that *Effect* takes care of a cognitive procedure in the brain of a *Subject. Meaning* remembers on communicating of knowledge = the stored *Information.*

The three main types of *Signs by PEIRCE* (*Icon, Index and Symbol)* are usable in same way as they are defined = as special types of *Information in IAs.* Perhaps we can add that the term *Symbol* is used today as criterion for higher ability of our brain. *Icon and Index* got IT-specific equivalents and are used more in that way in IT, but are valid too in original definition of PEIRCE (for instance *Icons* in Graphics and *Index* as variable term in mathematics).

8.2. IAs and Information Modell by C.W. MORRIS

The definition of *Syntax by MORRIS* can be equivalent defined as set of *Rules* for all *Signs by MORRIS.* Only these *Signs and Rules* define his *Syntax.*

There is no human connection for more interpreting or explaining purposes. These *Signs by MORRIS* are abstract graphics, letters or integers. *Rules* form new *Signs.* They have no other relevance.



So a perhaps wanted equivalence to the term *Data by IAs* can be found. *Data by IAs* exist and are generated *Objects* too. The rules to use *Data* are defined in their structure. All together – the form of *Signs* and the rules for using them – are defined as *Syntax by MORRIS* = form or structure of the term *DATA in IAs.* Perhaps we can say: *Syntax by MORRIS* contains all properties of *Data in IAs* – but not more.

The term *Information in IAs* contains more. The term *Semantic by MORRIS* is included only in parts in *Information*. The term *Information by IAs* needs a human connection per se. But MORRIS demands for his *Semantic* a relation to an *Object* only.

By *Semantic of MORRIS* we need his *Signs* and *Objects*. Only in connection between *Signs* and *Objects* the *Semantic* is defined. That's useable if we take *Signs by MORRIS* as abstracts for *Objects* and *Semantic* as defined description of this relation by rules between *Signs.*

Mainly in IT these terms get sense: *Signs by MORRIS* are defined abstract variables for correlated IT-data (= a great group of *Data in AIs*). The *Signs* in a computer program (= in defined *Syntax by MORRIS*) are representing the rules. Every *Sign* has a *Semantic* by his relation to valid *Objects* = IT-data.

The term *Pragmatic by MORRIS* gets sense only in (perhaps creative) philosophy. In IT is to find no other sense for this term.

But the term *Information in IAs* can be seen as basis or main element for *Pragmatic by MORRIS.* Without *Information in IAs* no *Pragmatic by MORRIS* is possible.

8.3. IAs and the trias "Form-Content-Effect" by K.FUCHS-KITTOWSKY

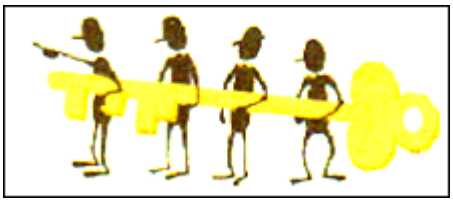
Form and Syntax by FUCHS-KITTOWSKY can be seen as properties of an *(living or material) Object*. If the *Object* is living we can speak from biological structure or *"living" Data as in AIs.*

The term "Organization" as MATURANA defined it can be seen as *Content or Semantic* and a little bit as *Action or Pragmatic by FUCHS-KITTOWSKY.*

If the *Object* is not living *Content and Semantic by FUCHS-KITTOWSKY* get a fitting usage in IS. They can be seen as properties of an *Object* which are recognizes by a (mainly human) *Subject.* FUCHS-KITTOWSKY includes the (human) *Information in IAs.*

The term *Meaning by PEIRCE* seems to be the result of recognizing the *Content or Semantic by FUCHS-KITTOWSKY* - as exact *Sign by PEIRCE* and *Information in IAs.*

This Information in IAs = Content or Semantic by FUCHS-KITTOWSKY initiates an *Effect, Action, Output or Pragmatic by FUCHS-KITT* OWSKY. The important term is the knowledge of the *Human Being = Subject in IAs.* A human *Action* is starting only if the human being is sure to



do the right, if his feeling (= optimal correlation of all his stored *"living Data" as in IAs*) initiates it. That is only possible if the knowledge (= *living Data as in IAs)* in our brain is great and deep enough.

The habit of a *Subject* includes a *Pragmatic by FUCHS-KITTOWSKY.* In IS or common philosophy we define pragmatic as acting or way of thinking which is fixed and has no intension to change. This pragmatic perhaps can be compared with the *Pragmatic by FUCHS-KITTOWSKY,* if we see a pragmatic habit as result of cognition for a long time and with a lot of recursive cognitive circles and much social communication between all reachable *Subjects*.

To *Pragmatic by FUCHS-KITTOWSKY* we can come if we use the nearly exact equivalence of building the *Sign* type *Symbol by PEIRCE* in our brain.

8.4. IAs and CAPURRO´s Trilemma

This trilemma is named in honor to R. CAPURRO (* 1945 in Montevideo, Uruguay), teaching as philosopher and information scientist in Stuttgart (Germany), by Peter FLEISSNER and Wolfgang HOFKIRCHNER, information scientists in Vienna, Austria.

It is used here as critical and definitive criterion for the IAs of Franz PLOCHBERGER (2011):

a) Synonymy or Univocally

The new term *Data in IAs* is a nature scientific and information technological existing fact. This term makes a selective abstraction of the much more manifold used word and term *Information by F.PLOCHBERGER* possible. The claimed attribute for a term is realized and true by the axiomatic way used by F.PLOCHBERGER. As he defines his terms *Data and Information* **are** synonym and univocal.

b) Analogism

As primum analogatum all used words of information can be used. All together are elements of the set "all known usages". The logic abstraction is done by taking care on some (exactly two) properties of all of them:

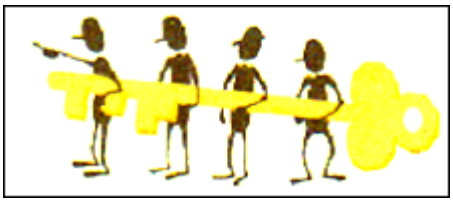
1) **all are data or objects and**
2) **have to be recognized by a human or any other living subject**

c) Equivocally

Different definitions can only exist, if no relation is possible. In most cases this relation can be created by scientific exact differentiation and integration.

If someone wants to create a conscious controversy term that's of course possible. In sense of philosophy of dialectic every sentence (logical or linguistic) can be negotiated. In equivalence to the third IS-proposal (IP3) of F.PLOCHBERGER (2012) a synthesis is always possible.

So IAs and IPs of Franz PLOCHBERGER (2012) can be valued as positive to all three criterions of CAPURRO´s Trilemma (1995).



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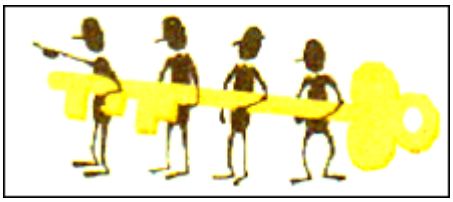

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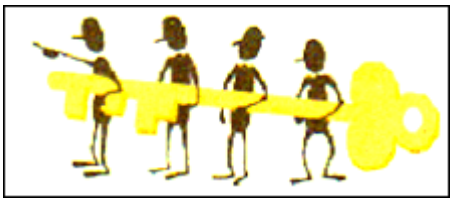

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